

**Appl. No. 09/945,393**

**REMARKS**

Claims 1-7, 20-24, 26, 27, 35-38, 45-49, and 53-56 are pending in the application with claims 1, 20, 36, 45, and 53-56 amended herein and claims 25 and 50-52 canceled herein. Applicant expresses appreciation for the indication that claims 25, 35, and 50 set forth allowable subject matter. Claims 20 and 45 are amended herein to incorporate the entire subject matter of respective allowable claims 25 and 50. Claim 35 is independent. Claims 21-24, 26, and 27 depend from claim 20 and claims 46-49 depend from claim 45. Accordingly, claims 20-24, 26, 27, 35, and 45-49 are in condition for allowance.

Claims 1-7, 36-38, and 53-56 stand rejected under 35 U.S.C. 103(a) as being unpatentable over Raaijmakers et al. Applicant requests reconsideration.

Amended claim 53 sets forth a dielectric material forming method that includes, among other features, atomic layer depositing alternated monolayers of a first dielectric material consisting of tantalum and oxygen, a second dielectric material consisting of zirconium and oxygen, and a third dielectric material consisting of titanium and oxygen. Of the monolayers, 8-10% are monolayers of the second material and 5-15% are monolayers of the third material. The method includes annealing the monolayers, the annealed dielectric material exhibiting a dielectric constant greater than the first material and second material and less current leakage than the first material. Pages 2-3 of the Office Action allege that Raaijmakers suggests every limitation of previous claim 54, the entire subject matter of which is incorporated by amendment into claim 53. Applicant traverses. Since claim 54 was previously before the Office, any new ground of rejection of amended claim 53 must be presented in a non-final rejection.

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Even though paragraphs 115, 117, 123-127, and 151 of Raaijmakers allegedly describe a method of forming a stack of distinct dielectric sublayers, Applicant asserts that Raaijmakers fails to disclose or suggest every limitation of amended claim 53. Specifically, Raaijmakers fails to suggest the combination of tantalum, titanium, zirconium, and oxygen in the manner claimed. Also, Raaijmakers fails to disclose or suggest 8-10% of the monolayers consisting of zirconium and oxygen and 5-15% of the monolayers consisting of titanium and oxygen. Further, Applicant asserts that Raaijmakers fails to disclose or suggest the annealed dielectric material exhibiting less current leakage than the first dielectric material.

Page 3 of the Office Action acknowledges that Raaijmakers does not appear to expressly disclose combining monolayers of tantalum and oxygen with monolayers of zirconium and oxygen. Instead, the Office Action relies upon an alleged motivation to combine such materials to produce the ternary metal oxide compounds of Raaijmakers' paragraph 117. However, Applicant asserts that Raaijmakers fails to motivate forming a quaternary metal oxide compound or to provide the current leakage properties, as set forth in amended claim 53.

Regardless of whether paragraphs 124-127 and 151 of Raaijmakers describe a  $\text{TiO}_2/\text{Ta}_2\text{O}_5$  dielectric stack, Raaijmakers fails to recognize the advantage of including zirconium oxide set forth in paragraph 24 of the present specification to preferentially address current leakage. Also, Raaijmakers fails to disclose or suggest the preferred composition ranges set forth in claim 53 and discussed in paragraph 35 of the present specification. The Office Action relies upon discussion in Raaijmakers' paragraph 69 of a 3:1 and 1:1 ratio of different metals in a dielectric and a discussion in paragraph 117 of "a slight doping effect" as allegedly suggesting the specific composition ranges set

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forth in claim 53 (previous claim 54). Only Applicant's own disclosure identifies the combination of monolayers of tantalum and oxygen, zirconium and oxygen, and titanium and oxygen as well as the preferred compositional ranges.

Page 3 of the Office Action alleges that "it would not require undue experimentation to arrive at the recited mixed metal oxides." However, "undue experimentation" does not constitute a proper standard for evaluating obviousness. Instead, the Office must show that the prior art suggests making the claimed composition, that the prior art reveals a reasonable expectation of success, and that the prior art teaches or suggests every claim limitation.

Applicant traverses the Office's allegation that Raaijmakers suggests that those of ordinary skill carry out the amended claim 53 method to produce the claimed composition merely because "it would not require undue experimentation." The chemical arts are well recognized for their unpredictability. Without a more specific motivation beyond mere random trial and error using Raaijmakers' materials, the Office Action cannot support the allegation that Raaijmakers suggests making the claimed composition. Page 3 of the Office Action assumes that those of ordinary skill would be motivated to form the claimed composition to produce the enhanced dielectric constant desired in Raaijmakers. However, no substantial evidence is alleged that those of ordinary skill recognize the claimed composition as one that will provide an enhanced dielectric constant. Raaijmakers is silent as to the effect on dielectric constant of the specific, claimed combination of materials and compositional ranges. In the unpredictable arts, no reasonable basis exists for making the assumption of enhanced dielectric constant alleged in the Office Action. Accordingly, Raaijmakers does not suggest making the claimed composition.

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Also, the prior art does not reveal any reasonable expectation of success to produce less current leakage. The Office Action does not allege substantial evidence supporting a conclusion that the combination of materials in claim 53 would produce the desired properties. Only Applicant's own specification reveals a preference for zirconium in reducing current leakage. Applicant notes that paragraph 62 of Raaijmakers summarizes its teachings regarding current leakage. Specifically, Raaijmakers teaches that current leakage is a function of dielectric thickness. Raaijmakers fails to disclose or suggest that current leakage is a function of composition, as discussed in the present specification. Accordingly, those of ordinary skill do not possess a reasonable expectation of success in providing less current leakage by forming the composition set forth in claim 53.

At least for the above reasons, Applicant asserts that claim 53 is patentable over Raaijmakers. Claim 54 depends from claim 53 and further specifies that 10% of the monolayers consist of zirconium and oxygen and 8% of the monolayers consist of titanium and oxygen. Raaijmakers fails to disclose or suggest the preferred composition set forth in claim 54 and supported at least by paragraph 35 of the present specification.

Claim 55 sets forth an enhanced dielectric material that includes, among other features, alternated, atomic layer deposited monolayers of a first dielectric material consisting of tantalum and oxygen, a second dielectric material consisting of zirconium and oxygen, and a third dielectric material consisting of titanium and oxygen. Of the monolayers, 8-10% are monolayers of the second material, 5-15% are monolayers of the third material, and the enhanced dielectric material exhibits less current leakage than the first material. Claim 56 depends from claim 55 and sets forth that 10% of the

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monolayers consist of zirconium and oxygen and 8% of the monolayers consist of titanium and oxygen. As may be appreciated from the discussion above regarding the deficiencies of Raaijmakers as applied to claims 53 and 54, Raaijmakers fails to disclose or suggest every limitation of claims 55 and 56.

Amended claim 1 sets forth a dielectric material forming method that includes, among other features, forming a second monolayer on a first monolayer, where one contains tantalum and oxygen and the other contains oxygen and zirconium. The method includes forming a dielectric layer containing the first and second monolayers with 5-15% of the dielectric layer being the other monolayer. The dielectric layer exhibits a dielectric constant greater than the first monolayer and second monolayer. Applicant notes that amended claim 1 incorporates the entire subject matter of previous claim 51, which was before the Office previously.

In comparison to amended claim 53, Applicant notes that claim 1 lacks some of the limitations argued as distinguishing Raaijmakers. However, Applicant asserts that the fewer limitations of claim 1 nevertheless distinguish Raaijmakers. Namely, Raaijmakers' motivation to produce enhanced dielectric properties coupled with random experimentation guided by dielectric materials disclosed only individually in Raaijmakers is not sufficient to suggest that those of ordinary skill form a combination of such materials with the claimed compositional range. Also, Raaijmakers does not reveal that those of ordinary skill have a reasonable expectation of success to produce the claimed dielectric constant using the composition set forth in claim 1. Mere disclosure of metal ratios of 3:1 and 1:1 along with discussion of a "slight doping effect" is not sufficient given the unpredictability in the chemical arts. Accordingly, claim 1 is patentable over Raaijmakers. Claims 2-7 depend from claim 1 and are patentable at least for such

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reason as well as for the additional limitations of such claims not disclosed or suggested.

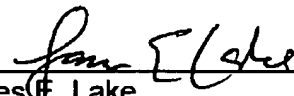
Amended claim 36 sets forth a dielectric layer that includes, among other features, a first monolayer containing tantalum and oxygen and a second monolayer containing oxygen and zirconium with 5-15% of the dielectric layer being oxygen and zirconium. The dielectric layer exhibits a dielectric constant greater than the first monolayer and second monolayer. Applicant notes that amended claim 36 incorporates the entire subject matter of previous claim 52, which was before the Office previously. As may be appreciated from the discussion above regarding the deficiencies of Raaijmakers as applied to claim 1, Raaijmakers fails to disclose or suggest every limitation of claim 36. Claims 37 and 38 depend from claim 36 and are patentable at least for such reason as well as for the additional limitations of such claims not disclosed or suggested.

Applicant herein establishes adequate reasons supporting patentability of claims 1-7, 20-24, 26, 27, 35-38, 45-49, and 53-56 and requests allowance of all pending claims in the next Office Action.

Respectfully submitted,

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